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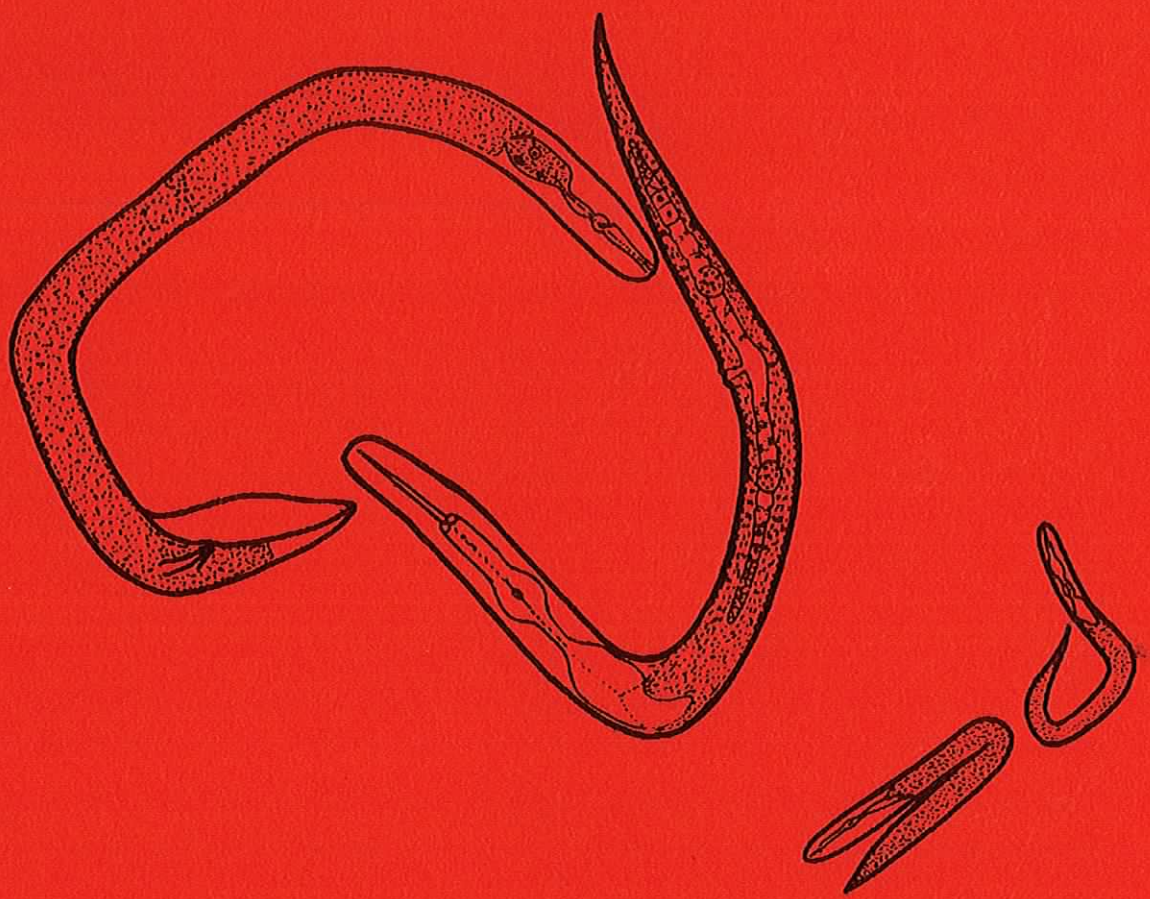
AUSTRALASIAN NEMATOLOGY NEWSLETTER



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ASSOCIATION NEWS

In the last newsletter, I asked for nominations and expressions of interest from those interested in serving on the next AAN Executive. The following nominations have been received and, since there was only one nomination for each position, a ballot will not be necessary.

The AAN Executive for the two years following the APPS meeting in Sydney will be:

President:	Graham Stirling
Secretary:	Julie Stanton
Treasurer:	Lynette West
Newsletter Editor:	Russell Eastwood
Committee Member:	John Marshall

I'd like to thank these people for being willing to accept a position on the Executive, and particularly Russell Eastwood for taking on the job of Newsletter Editor.

To give members an opportunity to comment on any aspect of AAN, a general meeting of the Association will be held at the Sydney conference at lunchtime on Thursday October 10. Please check the conference programme for exact details of venue and time.

(G.R. Stirling, Secretary)

Nematode taxonomy workshop. APPS Conference, Sydney
October 7-8, 1991

Planning for the workshop is now well advanced. The main thing I ask of participants is that they bring with them slides that are of interest to them, or that might interest others. There should be ample time at the workshop to look at specimens which you may be having trouble identifying.

(G.R. Stirling, QDPI)

From the Editor

This is the last newsletter which I shall edit. Thanks to all of you who have contributed and made the task not too burdensome.

Russell Eastwood will be our next editor. He claims that he is not a good typist and asks that, wherever possible, you send your contributions to him as a Wordperfect or ASCII file on disk. The deadline for contributions for the next issue is December 15, 1991. Please send your articles to:

Russell Eastwood
Victorian Institute of Dryland Agriculture
Private Bag 260
HORSHAM VIC 3400

Frances Reay at Waite Institute has sent me some information on the new Afro-Asian Society of Nematologists. I have included this along with a membership form in this issue.

Thanks for your support over the last two years and I hope to see you all at the conference in Sydney.

(Julie Stanton)
NEWSLETTER EDITOR

NEW MEMBERS

Mr Brendon Blair
BSES
PO Box 566
TULLY Q 4854

Telephone: (070) 68 1488
Facsimile: (070) 68 1907

Nematodes on sugarcane

Mr Michael Hodda
Ecosystem Dynamics Group
Research School of Biological Science
Australian National University
GPO Box 475
CANBERRA ACT 2601

Free-living nematodes

Mr John Lewis
SA Department of Agriculture
Field Crops Pathology Group
Private Mail Bag 1
GLEN OSMOND SA 5064

Mrs Milanka Matic
SA Department of Agriculture
Field Crops Pathology Group
Private Mail Bag 1
GLEN OSMOND SA 5064

CHANGES OF ADDRESS

Mr Grant Baldwin
Incitec Ltd
Development Manager (Southern)
PO Box 566
BLAIR ATHOL SA 5084

Telephone: (08) 258 2233
Facsimile: (08) 281 3697

Dr Barrie Thistlethwayte
4 Chestnut Grove
MAGILL SA 5072

Telephone: (08) 364 0091

CURRENT RESEARCH

Recent research at QWRI on crop rotations to control root-lesion nematode (*Pratylenchus thornei*)

Intolerant wheat varieties can suffer yield losses of up to 85% from attack by root-lesion nematode (*P. thornei*). Where this species occurs on the Darling Downs of Queensland, farmers can avoid serious losses by following crop rotations that avoid growing wheat more often than once every 4 years. Rotations have evolved that include the summer crop sorghum and the winter crop barley, both of which are quite tolerant. Most other crops tolerate nematode attack better than wheat. However, some that may suffer some yield loss are chickpea, mungbean and maize. *P. thornei* disrupts the normal functioning of roots making them inefficient for uptake of soil water and nutrients. Thus intolerant wheat crops under attack from nematodes can appear nutrient-deficient with lower leaf yellowing and/or drought-stressed with leaf wilting. Affected plants are stunted, with poor tillering and reduced grain yield.

The best host for *P. thornei* is wheat. The nematode is probably spread from paddock to paddock in soil adhering to farm machinery. Once the nematode is introduced, it builds up on successive wheat crops until damaging populations of more than several hundred per 200 g soil are reached. Thus continuous wheat culture is particularly conducive to the development of large nematode populations in the soil profile. Once populations of nematodes are established in the soil profile they are impossible to eradicate. The nematode survives well soil in the absence of a host, so there will always be some survivors after long periods of weed-free fallow. We have clean-fallowed one area for 4.5 years during which time the population fell to 5% of initial numbers, surviving deeper in the soil profile at several hundred/200 g soil. In another that was clean-fallowed for 8 years there were still 95 nemas/200 g soil in the 15-45 cm depth layer.

The first wheat crop after numbers have been depleted will suffer little damage, but will permit the nematodes to build up to high levels to attack a subsequent crop. For example, at both the above-mentioned long-fallow sites, populations increased to several thousand/200g soil with the growth of just one wheat crop. In another experiment at the first site, other crops that built up nematodes to moderate numbers were mungbean, chickpea, maize, triticale and barley. A poorer host was sorghum which may simply maintain numbers just above fallow levels. Crops which were very poor hosts and would allow numbers to decline comparable to fallowing are canary seed, rapeseed, linseed, sunflower, pigeonpea and panicum.

(John Thompson, Queensland Wheat Research Institute, Toowoomba)

"Forms" of nematodes of the detritus food web

An assessment of races of plant-feeding nematodes and plant cultivars was given in Yeates (1987) and recently there has been a report on nomenclature of races (Huettel 1990). In nematodes of the detritus food web, while the potentially strong influence of plant cultivar is absent, variability within nominal species may be great, both in natural, field populations and in laboratory cultures.

In *Clarkus papillatus* and *Prionchulus punctatus* (Mononchoidea) Arpin *et al.* (1988) have shown statistically significant differences in stoma morphometrics related to both humus type and season. In contrast Zell (1985) divided the cosmopolitan *Wilsonema otophorum* and *Tylocephalus auriculatus* (Plectidae) into 3 and 6 sibling species respectively. In the Cephalobidae, Bostrom (1988) thought it possible that four *Acrobeloides* species (*A. tricornis, A. setosus, A. uberrinus, A. syrtisus*) may all be populations of one morphospecies (*A. tricornis*). In contrast, work with species of *Panagrolaimus* (Panagrolaimidae) by Bostrom (1989) and Sohlenius (1989) showed that classical species were not only distinct when examined by electron microscopy but that two such species could coexist in nature and for five years in laboratory culture.

Determination of races may be critical in managing plant pathogenic nematodes through cropping practice. Determination of sibling species in comprehensive collections of nematode species may aid interpretation of recent biogeoraphical changes. However, in much survey work where a limited amount of preserved material is available and a principal aim is to assess faunal diversity or ecosystem stability the traditional morphological nematode species is both inescapable and satisfactory.

Arpin, P., Akkerhuis, G.J., Ponge, J-F. (1988) Morphometric variability in *Clarkus papillatus* (Bastian, 1865) Jairajpuri, 1970 in relation to humus type and season. *Revue de Nématologie* 11:149-158.

Bostrom, S. (1987) A scanning elctron microscope study of some species of terrestrial nematodes from Spitzbergen. *Nematologica* 33:366-374.

Bostrom, S. (1988) Descriptions and morphological variability of three populations of *Panagrolaimus* Fuchs, 1930 (Nematoda: Panagrolaimidae). *Nematologica* 34:144-155.

Huettel,R.N. (Chairman) (1990) Report from the intraspecific race designation committee. *Nematology Newsletter* 36(4):3.

Sohlenius, B. (1988) Interactions between two species of *Panagrolaimus* in agar cultures. *Nematologica* 34:208-217.

Yeates, G.W. (1987) How plant affect nematodes. *Advances in Ecological Reserach* 17: 61-113.

Zell, H. (1985) Nematoden eines Buchenwaldbodens. 5. Die Wilsonematinae (Nematoda, Araeolaimida). *Carolinea* 43:77-92.

(Gregor Yeates, DSIR Land Resources, Lower Hutt, N.Z.)

Nematodes and sportsturf

At the Australian Turfgrass Research Institute we extract and identify nematodes from sportsturf, predominantly for the bowling and golf industries. Whilst this service in available year round, we find it is the warmer months of December through to March where there is most demand. A green affected by nematodes expresses symptoms which resemble heat stress (yellowing, stunted unthrifty turf) that does not respond to watering or nutrients (applied as fertilisers). these symptoms, when caused by a moderate to sever number of nematodes (100 to 200 per 200g soil), most certainly affect a playing surface.

Sandy, free-draining soils seem to be affected more than the more compacfted, heavier soil greens. The Hunter Valley region of New South Wales seems to be prone to heavier infestations than those we consider normal.

Control within the industry is through pesticides rather than cultural practices. The main nematodes encountered being *Helicotylenchus* spp., *Hemicycliophora* spp. and *Belonolaimus lolii*.

The extent or distribution of nematodes in sportsturf has not yet been surveyed or studied - a most interesting and useful project should we be able to interest an agricultural student to adopt it as a project/thesis.

(Melissa Haslam, Senior Technical Officer, Australian Turf Research Institute, NSW)

REGIONAL NEWS

NEWS FROM SOUTH AUSTRALIA

Forking around South Australia

Much of my time has recently been taken up by inspections of potato crops destined for export to Western Australia. Since the Victorian outbreak of Potato Cyst Nematode (PCN), Western Australia has imposed conditions on the import of potatoes grown interstate. South Australian exporters must have their crops inspected for PCN, preferably by plant (fork) sampling on a 10 row x 10 m grid. To enable these growers to comply with these conditions, the Department of Agriculture was obliged to offer an inspection service at short notice.

PCN has never been reported from South Australia; extensive suveys by fork sampling in 1986/87 failed to detect it. Nevertheless, the nematode had apparently been present, undetected, in Western Australia and Victoria for some years and we are still learning about the distribution of PCN in Australia. Moreover, the sensitivity of the Western Australian authorities is to some extent understandable given the seriousness of the pest, the considerable lengths to which they have gone to counter the limited outbreak near Perth and the admitted reliancer of the South Australian industry on Victorian seed potatoes.

Due to a shortage of State inspection staff, initial implementation of this service relied on the goodwill of myself and certain Loxton colleagues I was able to co-opt. I have now trained a pool of casual labour and hope to retire from actual inspection work, while maintaining an ongoing role in sample identification, soil extraction in cases where plant sampling is not possible and in staff training. Hiring of casual labour has been facilitated by charges levied on growers for inspections (of $20.50 per hour). Preserved material and photos and a video produced by the Western Australian Department of Agriculture have been useful in training staff. Fresh material for this purpose was, of course, unavailable.

Most of the requests for inspections have been for crops in the Riverland and Murray Mallee districts which have experienced an enormous expansion of vegetable production in recent years, chiefly under centre-pivot irrigation. The size of centre-pivot crops (up to 40 ha) is truly daunting when undertaking inspections. Dense growth can hinder progress and a traverse across the centre of the pivot may take 45 minutes or more. A team of at least 5 or 6 people is desirable since smaller teams can easily become dispirited in the face of such large acreages. Maintaining motivation under these circumstances is a potential problem, particularly when, as in most cases in the Riverland and Murray Mallee, the ground is fairly "new" and long rotations are the norm, minimising the expectation of actually finding PCN.

However, our team remained remarkbaly cheerful, conscientious and productive, easily exceeding the preliminary estimates of inspection times per ha. It helped that we were assisting local growers who would otherwise have been in a bind and that the season had not yet broken, meaning fine weather prevailed. Indeed, I must confess to largely enjoying my involvement, although glad it is not a continuing one and having waged a paper war with those responsible for dumping this in my lap, if only on principle. I can even see benefits in extending the scheme. Perhaps, on reflection, the Chinese Cultural Revolution was not att bad; I am sure ANN readers could recommend a brace of bureaucrats who could benefits from a few weeks/months/years (strike out whichever is inapplicable) of fork testing. Fresh air, teamwork and the novel experience of actually doing something of direct benefit to growers could indeed be revolutionary.

ARGT bacterium teams up with a new nematode vector to infect *Agrostis avenacea* and *Polypogon monspeliensis*

In October last year, cattle were being poisoned in the flood plains of the Bogan River in northern NSW. The condition known locally as Flood Plain Staggers (FPS) had not been seen before. By the end of summer, 1400 cattle, 300 sheep and 11 horses had been killed. Outbreaks occurred along the flood plains of rivers in the Darling catchment area bounded by Bourke, Moree and Coolibah.

A team from the University of Sydney led by Associate Professor Lester Burgess found that the native blown grass (*Agrostis avenacea*) was the source of the toxin. Eric Davis, Veterinary Officer at Bourke, had observed distorted blown grass seed heads covered with an orange crystalline substance. I was asked to examine samples of the seed heads and samples of the grass used in the feeding trial. The orange substance resembled dried bacterial slime associated with annual ryegrass toxicity (ARGT). Examination of the grass from the feeding trial revealed seed galls containing second-stage juveniles of an *Anguina* sp. (*Editor's note: ARGT is caused by a toxin produced by the bacterium,* Clavibacter *sp., which is carried into seed heads of annual ryegrass by the nematode,* Anguina funesta. *Annually it kills about 20,000 sheep in Western Australia and 3,000 in South Australia.*)

Meanwhile in the south east of South Australia, sheep and cattle deaths caused by Stewarts Range Syndrome (SRS) were again being reported. SRS had caused stock losses annually for more than twenty years in flood-prone pastures dominated by the introduced annual beard grass (*Polypogon monspeliensis*). The cause of SRS had not been identified. A week following the discovery that the toxic blown grass was infested with a bacterium and an *Anguina* nematode, Colin Trengrove, Regional Veterinary Officer, and I found that annual beard grass in toxic pastures was infected with a bacterium and a nematode.

I enlisted the assistance of Dr Kathy Ophel from the Waite Agricultural Research Institute and Terry Reardon from the South Australian Museum's Evolutionary Biology Unit to help identify the nematode and the bacterium. A number of tests, including serology, allozyme electrophoresis and bacteriophage specificity, showed

that the bacteria associated with FPS and SRS were indistinguishable from that associated with ARGT. The bacteriophage appears to be related to toxin production and is often lost when the bacterium is cultured on artificial media. Bacteriophage were isolated from bacterial slime from blown grass and annual beard grass. DNA restriction patterns showed that the same bacteriophage was associated with FPS, SRS and ARGT.

Samples of bacterial infected blown and beard grass were sent to Dr John Edgar, CSIRO Division of Animal Health. His group confirmed that the ARGT toxins, known as corynetoxins, were present in infected blown grass and annual beard grass.

So far, only allozyme electrophoresis has been used to identify the nematode. The nematode on blown grass and annual beard grass was compared with *Anguina funesta* from annual ryegrass, *Anguina agrostis* from *Agrostis capillaris* in New Zealand, *Anguina tritici* from Western Australia and an *Anguina* sp. from *Holcus lanatus* in South Australia. The results show that the nematodes on blown grass and annual beard grass were in the same species but that it differed from all of the other species tested. We have to wait till adults are produced in the spring to determine if the nematode has been described.

The discovery that other species of *Anguina* can vector the ARGT bacterium causes concern. No longer is ARGT confined to annual ryegrass in the cropping belt. The host range of the new nematode still has to be determined. Other native and introduced grasses may be at risk. Also, other *Anguina* nematodes may vector the bacterium and so further increase the range of grasses at risk.

It is fortunate that with FPS and SRS the symptoms on the grass are easy to see, unlike annual ryegrass, where heavily infected plants often appear healthy. Producers should be able to identify high risk paddocks before stock are poisoned. Given that the symptoms on annual beard grass are easily seen it is surprising that it took more than 20 years for the nematode and bacterium to be found.

Back to ARGT. The largest single stock loss caused by ARGT now stands at 1750 sheep killed out of a mob of 2500. This occurred on a property in Western Austrlaia. It was the first outbreak of ARGT on the property.

Despite the discovery that the ARGT bacterium occurs on blown grass in the pastoral areas in northern New South Wales, there have still been no reports of ARGT causing stock losses on annual ryegrass pastures in New South Wales or Victoria.

To finish on a positive note, production of seed for the first ARGT nematode-resistant annual ryegrass variety has commenced. Field evaluation will start next year, and seed should be available commercially in 1994.

(Alan McKay, Senior Research Officer, SA Department of Agriculture)

NEWS FROM QUEENSLAND

Development of diagnostic probes to identify species and races of root-knot nematode.

Integrated control of root-knot nematodes involves the use of non-host rotation crops and resistant cultivars. To make recommendations on suitable crops, it is necessary to identify the species and race of nematode involved. Presently, identification of root-knot nematodes depends on morphological studies, which are inaccurate, and on host range testing, which takes at least 8 weeks. The nematology section at QDPI, in collaboration with Dr Craig Moritz (Department of Zoology, University of Queensland) and Dr John Curran (Division of Entomology, CSIRO), aims to develop DNA probes for accurate, rapid and simple identification of root-knot nematodes.

So far, we have collected more than 110 root-knot nematode populations from most Australian States. Greg Walker and Margaret Graham have been especially helpful in sending samples. Morphological characters indicate that all four common species of root-knot nematode are well represented and have been collected from several different hosts in different regions. *Meloidogyne hispanica* has also been recorded for the first time in Australia at Applethorpe Research Station on grapevines. However, we would still like more populations, especially from unusual crops or environments. If you can help, could you send soil and/or roots to Julie Stanton, Plant Pathology Branch, QDPI, Meiers Road, Indooroopilly Q 4068.

Characters which will be used to identify important differences between populations include perineal patterns, morphometric studies, host range, enzyme electrophoresis and karyotypes.

An extended host range will be devised to differentiate populations of *Meloidogyne* in order to study the relationship between genetic grouping and host reaction. The standard differential host range, developed in USA, is not sufficient to distinguish some Australian populations. For example, two different atypical variants of *M. arenaria* race 2 have been found on tobacco in north Queensland as well as the typical. Although all three populations react similarly to the standard host range, there are differences in reactions to tobacco cultivars and crops which might be used in rotation with tobacco. When making management recommendations, it is important that these populations be distinguished.

Molecular work began with ribosomal DNA but its unusual organization in *Meloidogyne* would provide an unstable and inconsistent marker for distinguishing populations. Therefore, attention has turned to restriction fragment length polymorphisms (RFLP's) in mitochondrial DNA (mtDNA). Many populations have been tested with several restriction enzymes and at least five different haplotypes identified using EcoRI, HindIII, DraI and MboI. Discrepancies between perineal patterns and haplotypes emphasise the lack of reliability in using morphology for identification.

The mitochondrial genomes show considerable variation in size ranging from 19 to 22 kb (kilobase pairs), similar to the American studies. The mt DNA of one population is distinct and, at 26 kb, is unusually large.

As a step towards simplifying the mitochondrial genome studies, we have devised, from the literature, polymerase chain reaction (PCR) primers to a section of the mtDNA that shows RFLP's, and have shown that cutting the 1.8 kb amplified band with EcoRI can distinguish some haplotypes. This augers well for designing a routine PCR-based assay for rapid diagnosis of field samples that will distinguish genetic groups with distinct host ranges.

(J.M. Stanton QDPI)

QDPI nematode collection

Unfortunately, the Queensland Department of Primary Industries nematode collection has been lying idle since Bob Colbran moved out of nematology in the mid 1970's. For many years, we have not had sufficient staff with interest and expertise in nematode taxonomy to maintain the collection in good repair. We now hope to redress this situation by transferring the collection to the Queensland Museum. We have recieved a grant from Rural Industries Research and Development Corporation (RIRDC) which will allow us to employ someone to catalogue the collection and selectively restore some of the important slides. The work will be carried out during the 1991/92 financial year and, at the end of the process, we hope to have a useful database and a collection that can be accessed easily by researchers.

(G.R. Stirling, Principal Nematologist, QDPI
L.R.G. Cannon, Senior Curator, Queensland Museum)

Mary Mertens, a post-graduate student from Wageningen Agricultural University, The Netherlands recently left Indooroopilly after spending 6 months in the nematology section. Mary did some interesting work on the natural control of *Meloidogyne* in a Queensland grape vineyard and a kiwifruit orchard. The fungal egg parasites, *Verticillium chlamydosporium* and *Paecilomyces lilacinus*, were present at these sites and Mary obtained data which suggested that they parasitised large numbers of eggs at both sites.

Mary also took the opportunity to have a look around Australia while she was here. She walked almost every national park in south-east Queensland and between Brisbane and Sydney, and also had a week in the Whitsundays. We enjoyed having her here and wish her well for her future in nematology.

(G.R. Stirling, QDPI)

WANTED - Nematology Position

I have a Ph.D. from the Department of Microbiology and Plant Pathology, Hebrew University, Israel (1990). Presently I am working with Dr Graham Stirling on the isolation and testing of nematophagous fungi for use in biological control and fermentation techniques. My areas of interest are soil microbiology, relationships between fungi, bacteria and nematodes and nematode cuticle biochemistry. The grant for my present research should terminate by the end of the year and I would like a position in nematological research in Australia.

(Dr Sergio Galper, Plant Pathology Branch, Queensland Department of Primary Industries, Meiers Road, Indooroopilly QLD 4068 - Telephone: (07) 877 9590; Facsimile: (07) 371 0866)

NEWS FROM WESTERN AUSTRALIA

Dr Ian Riley, currently at Department of Agriculture, Kununurra, will transfer to Plant Pathology Branch in South Perth and take up duties as a specialist nematologist in July. Ian trained as a bacteriologist and worked on annual ryegrass toxicity in South Australia before joining the Department at Kununurra three years ago.

He will quickly resume contact with the old enemy (ARGT) as supervisor of a new AWC project exploring possibilities for biological control of the nematode/bacterial association. He will initially look at biotic factors that may be associated with ARGT decline in various parts of Western Australia.

Further on ARGT; there is a major new initiative being taken in terms of money and approach by the use of spatial analysis to study ARGT on a regional basis. Danny Roberts and Leith Andrews have been granted $225,000 over three years to investigate effects of management, landscape, etc. on ARGT and to apply the results to predict occurrence and spread.

(from Western Australian Department of Agriculture Ag Brief Vol 1, No 2)

NEWS FROM VICTORIA

Well, the big news from Victoria has been the discovery of potato cyst nematode in the Dandenongs. This prompted an influx of nematological expertise from interstate and overseas which is much appreciated. Jill is collaborating with Rod McLeod and Chris Green on PCN taxonomy and has discovered a great diversity of cyst nematode species as well as root lesion nematode and root-knot nematode in these potato soils. A new lab has been set up to handle the influx of samples.

We are involved in three new initiatives in nematode resistance and training; 'The CCN Initiative' (DAV/CSIRO), the Victorian Strategic Research Foundation (DAV/State Govt) and a Cooperative Research Centre (CSIRO/DAV/QDPI/ANU) proposal. The CCNI was not funded this year but we are hopeful that the others will bear fruit and help raise awareness of nematodes.

Russell has spent a month at CSIRO Division of Plant Industry continuing work begun in 1990 studying variation in the CCN populations using RFLP's. He has several random clones derived from CCN that can be used as specific probes. Some problems were encountered with degraded DNA. This will be sorted out in Horsham before returning to Canberra later in the year to finish it off. (I hope).

The latest on the *Triticum tauschii* sources of resistance to CCN is that, of the seven lines identified as being resistant, it appears that each has either one of two independent single dominant genes. This is yet to be confimred. Our colleagues at CSIRO are presently mapping one of these genes in relation to molecular markers. We hope soon to have useful markers that can be used in the wheat breeding program.

We look forward to seeing you all at the APPS conference later in the year.

Recent publication:

Eastwood, R.F., Lagudah, E.S., Appels, R., Hannah, M. and Kollmorgen, J. (1991). *Triticum tauschii*: a novel source of resistance to cereal cyst nematode (*Heterodera avenae*). *Australian Journal of Agricultural Research* 42:69-77.

(R. Eastwood, VIDA Horsham and J. Hinch, IPS Burnley)

AFRO-ASIAN SOCIETY OF NEMATOLOGISTS

ANNOUNCE THE LAUNCH OF

A NEW PLANT NEMATOLOGY JOURNAL

The Afro-Asian Society of Nematologists (AASN) was founded in 1984 at Guelph, Canada, during the First International Nematology Congress. During the Second International Nematology Congress (SINC) held at Veldhoven, The Netherlands, the AASN held its General Body Meeting on 14th August, 1990 in which the five office-bearers, and 20 members of the Executive Committee (from various countries including China, Egypt, India, Iran, Japan, Sri Lanka, Tunisia, UK, and USA) were elected and the AASN Constitution was approved unanimously.

It was approved that the AASN should launch its official journal, *Afro-Asian Journal of Nematology (AAJN)* as a biannual from 1991; the first issue of the *AAJN* to come out in the Spring of 1991. An official announcement was made during the SINC's conference banquet on 16th August, 1990. All attending members and several non-members supported the proposed journal and several workers from India, Italy, Senegal, Spain and UK promised papers for the first issue. It was also decided to hold AASN's Symposium in Cairo, in 1993.

AFRO-ASIAN JOURNAL OF NEMATOLOGY

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FOR FURTHER INFORMATION PLEASE CONTACT:

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International Institute of Parasitology
395a Hatfield Road, St. Albans, Herts AL4 0XU, England, UK
Tel: (0727) 833151 Fax: (0727) 868721

Papers for publication are now invited in English or French in a format broadly conforming to that of *Nematologica*. They should be submitted in duplicate to the above, to one of the Editors or to one of the Editorial Board Members.

OFFICIAL INVOICE

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